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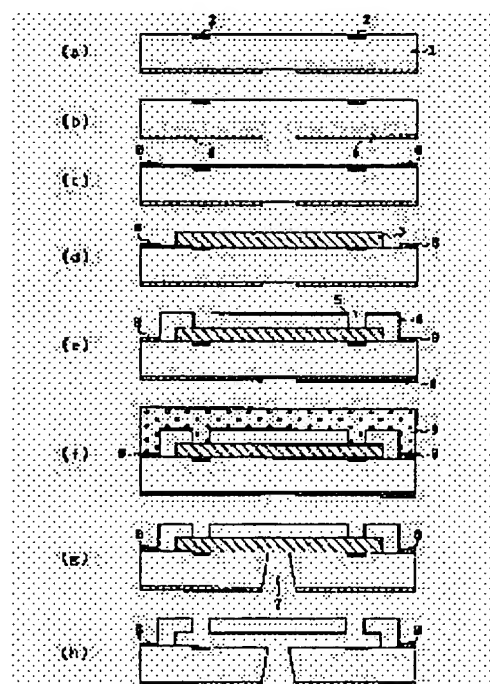
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## (54) PRODUCTION OF INK JET RECORDING HEAD, INK JET RECORDING HEAD AND INK JET RECORDING APPARATUS

### (57)Abstract:

PROBLEM TO BE SOLVED: To perform etching excellent in production efficiency in producing an ink jet recording head by wet etching.

SOLUTION: Functional elements constituting heating resistor elements or the drive circuits thereof are formed on the silicon substrate 1 constituting an ink jet recording head and, thereafter, ink supply orifices 7 are formed by wet etching. When a protective film 9 for protecting the functional elements or the like from an etching soln. is provided, the protective film and the predetermined layer on the surface of the substrate are brought to a contact state through an adhesion layer 8. By this constitution, the adhesion of the protective film 9 to the substrate is improved and the penetration of the etching soln. in the protective film can be well protected.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The manufacture approach of the ink-jet recording head characterized by to have the step which prepares the substrate which constitutes an ink-jet recording head in the manufacture approach of an ink-jet recording head of manufacturing the ink-jet recording head for carrying out the regurgitation of the ink including the process etched using an etching reagent, forms an adhesion layer in the perimeter of the device side formed on this substrate, and forms the protective coat for protecting said device side from said etching reagent through this adhesion layer.

[Claim 2] Said adhesion layer is the manufacture approach of the ink jet recording head according to claim 1 characterized by having polyether amide resin and being formed.

[Claim 3] Said protective coat is the manufacture approach of the ink jet recording head according to claim 1 or 2 characterized by being the coating agent of a cyclized-rubber system.

[Claim 4] It is the manufacture approach of an ink jet recording head of manufacturing ink in the ink jet recording head for carrying out the regurgitation including the process etched using an etching reagent. Prepare the substrate which constitutes an ink jet recording head, form an adhesion layer in the perimeter of the device side formed on this substrate, and this adhesion layer is minded. The ink jet recording head characterized by being manufactured by the manufacture approach with the step which forms the protective coat for protecting said device side from said etching reagent.

[Claim 5] Said adhesion layer is an ink jet recording head according to claim 4 characterized by having polyether amide resin and being formed.

[Claim 6] Said protective coat is an ink jet recording head according to claim 4 or 5 characterized by being the coating agent of a cyclized-rubber system.

[Claim 7] Said recording head is an ink jet recording head according to claim 4 to 6 characterized by making ink produce air bubbles using heat energy, and carrying out the regurgitation of the ink with the pressure of these air bubbles.

[Claim 8] It is an ink jet recording head for carrying out the regurgitation of the ink in the ink jet recording apparatus which records by breathing out ink. It is the manufacture approach of the ink jet recording head manufactured including the process etched using an etching reagent. Prepare the substrate which constitutes an ink jet recording head, form an adhesion layer in the perimeter of the device side formed on this substrate, and this adhesion layer is minded. The ink jet recording device characterized by recording using the ink JIETO recording head manufactured by the manufacture approach with the step which forms the protective coat for protecting said device side from said etching reagent.

[Claim 9] Said adhesion layer is an ink jet recording device according to claim 8 characterized by having polyether amide resin and being formed.

[Claim 10] Said protective coat is an ink jet recording device according to claim 8 or 9 characterized by being the coating agent of a cyclized-rubber system.

[Claim 11] Said recording head is an ink jet recording device according to claim 8 to 10 characterized by making ink produce air bubbles using heat energy, and carrying out the regurgitation of the ink with the pressure of these air bubbles.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[Field of the Invention]** Especially this invention relates to the approach of manufacturing an ink jet recording head by the chemical etching using an etching reagent, about the manufacture approach, ink jet recording head, and ink jet recording apparatus of an ink jet recording head.

**[0002]**

**[Description of the Prior Art]** When manufacturing the so-called side shooter type which carries out the regurgitation of the ink to an abbreviation perpendicular direction to the substrate with which the regurgitation energy generation component was prepared of ink jet recording head, an ink feed hopper is prepared by forming penetration opening in the substrate with which the regurgitation energy generation component was formed. And in this type of recording head, the method which supplies ink from the background of a substrate through an ink feed hopper is taken.

**[0003]** As the manufacture approach of such an ink jet recording head, the thing given in JP,62-264957,A and a U.S. Pat. No. 4789425 official report is known, for example. Here, the slot which forms above-mentioned penetration opening in the substrate with which the regurgitation energy generation component was formed, and becomes it with ink passage after that by the mechanical processing approach called sandblasting processing or ultrasonic grinding processing is formed. In addition, before forming penetration opening, it is also possible to form ink passage etc. Subsequently, the electrocasting plate in which the delivery was formed is pasted up on the above-mentioned substrate, carrying out alignment of the delivery, ink passage of a substrate, etc.

**[0004]** Moreover, it corresponds to the miniaturization of an ink jet recording head, densification, etc., and the thing in which the electric drive circuit (a diode-matrix circuit and shift register circuit) for driving a regurgitation energy generation component was formed on the substrate is also known for recent years. In case such a highly efficient recording head is manufactured, in using mechanical processing like sandblasting mentioned above to formation of an ink feed hopper, or ultrasonic grinding, since the above drive circuits are very sensitive in respect of static electricity-proof and vibration-proof, the above-mentioned processing approach becomes the factor which affects the circuit property, and big handling comparison cautions of processing are needed.

**[0005]** Then, as a means to solve such a problem, when using silicon for the ingredient of a substrate, the approach of forming penetration opening for ink feed hoppers by chemical etching from a substrate rear face is proposed. Since this approach carries out etching processing chemically and forms formation of penetration opening, it can be fundamentally set as arbitration at which process in the production process of an ink jet recording head that formation process is performed. That is, it also becomes possible to carry out by the final process in which the main functional division of an ink jet recording head was formed. That is, in the ink feed hopper formation by machining, although it carries out in an early phase comparatively, like this approach, the reinforcement of a substrate falls at the \*\* case in which the advantage of a recording head production process which can form penetration opening by the final process forms penetration opening in early stages of a process, and the handling by the manufacturing installation is the point which can solve the problem of become complicated.

[0006] Generally anisotropic etching using the etching reagent of the alkali system in respect of densification, such as a circuit pattern to form, with the advantageous chemical etching to silicon is performed. As an etching mask of an etching initiation side, the inorganic film, for example, the oxide film and nitride of silicon, is used. Moreover, as an etching reagent, what produces the etching speed difference by the crystal faces, such as TMAH (tetramethyl ammonium hydroxide), KOH, and a hydrazine, is used.

[0007] In such chemical etching, since the substrate front face in which circuits, such as a regurgitation energy generation component and its driver element, were formed is exposed to an etching reagent, the configuration which protects these circuits is needed. The approach of etching by carrying out the coat of what covers the circuit on a substrate conventionally, using a fixture as a configuration for it, and protects these circuits from an etching reagent, the thing which etches into the part in which the etching reagent is carrying out overflow by contacting the etching initiation side (rear face) of a substrate, without making wafers, such as silicon, immersed in an etching reagent, and the protective coat [ further as opposed to etching ] to a substrate front face is learned.

[0008]

[Problem(s) to be Solved by the Invention] However, the configuration for protecting the substrate front face mentioned above from an etching reagent had the respectively following problems.

[0009] That is, if the fixture was used for the substrate front face or it was in the etching method which contacts a substrate to an overflow side, there was a case where an etching reagent did damage to circuits, such as a surroundings lump regurgitation energy generation component and a driver element, on the surface of a wafer, by poor setting of the fixture to a wafer, and poor control of an etching oil level to overflow. The damage on this circuit means the polar zone of the exposed circuit etc. corroding with an etching reagent, or being destroyed to the component which the protective layer lower part mentioned above.

[0010] Moreover, when there is no problem in setting to the jig and overflow liquid of a wafer and the halt side (the inorganic film usually said to a wafer front face as the membrane film is stretched) of etching in silicon etc. is damaged according to a defect etc., an etching reagent may do damage to a substrate front face through there in a surroundings lump circuit.

[0011] The approach of using the above jig or contacting a substrate on an overflow oil level has a problem in respect of productivity, especially effectiveness again. That is, there is a problem which is the advantage of wet etching that a lot of batch processing is comparatively difficult.

[0012] Generally, although, as for an etching reagent, TMAH is used in consideration of the effect on safety and an environment, the etching time in that case requires 10 thru/or 30 hours, when the thickness of silicon is 625 micrometers. For this reason, a lot of batch processing might take great time amount, and batch processing could not be applied as a matter of fact, but it might become a problem in respect of productive efficiency.

[0013] The approach of applying an etching protective coat to the wafer front face mentioned above as other approaches of protecting the circuit on a substrate melts a wax, this is applied to a substrate, or carries out spreading desiccation of rubber like NEGAREJISUTO, and makes it a protective layer. However, such a protective layer is a substrate (as a protective layer of a circuit usually), although deterioration is not carried out to the etching reagent of an alkali system in itself. Since the adhesion by which the inorganic film, for example, diacid-ized silicon, a silicon nitride film, etc. are formed in the lower part of the above-mentioned protective layer is not enough, at the time of etching, are a wafer, especially it separates from a periphery. An etching reagent may contact the circuit on a substrate as the result, and damage may be done to a circuit.

[0014] The place which this invention is made for the purpose of solving the technical problem of the conventional technique mentioned above, and is made into the purpose is in the manufacture approach of an ink jet recording head of having used wet etching to offer the manufacture approach, ink jet recording head, and ink jet recording device of the ink jet recording head which can perform etching which was excellent in productive efficiency.

[0015]

[Means for Solving the Problem] Therefore, it sets to the manufacture approach of an ink jet recording head of manufacturing the ink jet recording head for carrying out the regurgitation of the ink in this invention including the process etched using an etching reagent. It is characterized by having the step which prepares

the substrate which constitutes an ink jet recording head, forms an adhesion layer in the perimeter of the device side formed on this substrate, and forms the protective coat for protecting said device side from said etching reagent through this adhesion layer.

[0016] It is the manufacture approach of the ink jet recording head manufactured including the process which is and is etched using an etching reagent. moreover, the ink jet recording head for carrying out the regurgitation of the ink -- Prepare the substrate which constitutes an ink jet recording head, form an adhesion layer in the perimeter of the device side formed on this substrate, and this adhesion layer is minded. It is characterized by being manufactured by the manufacture approach with the step which forms the protective coat for protecting said device side from said etching reagent.

[0017] Furthermore, it sets to the ink jet recording device which records by breathing out ink. It is an ink jet recording head for carrying out the regurgitation of the ink, and is the manufacture approach of the ink jet recording head manufactured including the process etched using an etching reagent. Prepare the substrate which constitutes an ink jet recording head, form an adhesion layer in the perimeter of the device side formed on this substrate, and this adhesion layer is minded. It is characterized by recording using the ink JIETO recording head manufactured by the manufacture approach with the step which forms the protective coat for protecting said device side from said etching reagent.

[0018] Since according to the above configuration the protective coat to the etching reagent used for etching is prepared and an adhesion layer is formed in the part which the predetermined layer of a protective coat and a substrate touches in this case, the adhesion of a protective coat and a substrate can be raised and it can prevent that an etching reagent permeates into a protective coat.

[0019]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained to a detail with reference to a drawing.

[0020] Drawing 1 (a) - (h) is drawing showing the production process of the ink jet recording head concerning 1 operation gestalt of this invention in order of a process. The recording head of this operation gestalt is a thing of the so-called Bubble Jet which ink is made to produce air bubbles and carries out the regurgitation of the ink with the heat energy using the exoergic resistance element which generates heat energy as a regurgitation energy generation component component. In addition, although the sectional view of a recording head is expressed with drawing 1 about the exoergic resistance element of one unit (pair), the liquid ink way, the delivery, etc., with this operation gestalt, two or more one chips for recording heads formed in a silicon substrate by carrying out two or more unit array of the exoergic resistance element are manufactured to coincidence like a general semi-conductor manufacturing technology.

[0021] In manufacture of the recording head of this operation gestalt, first, as shown in drawing 1 (a), the driver element circuit for performing the drive of the exoergic resistance element 2 and this component is formed by the same approach as a semi-conductor manufacturing technology on the silicon substrate 1 with the crystal orientation of <100> sides. In addition, only an exoergic resistance element is shown in drawing. Subsequently, an electric extraction electrode is formed for supplying a current to the exoergic resistance element 2 etc. That detailed explanation is omitted about this process. Moreover, it does not limit, especially concerning the manufacture approach.

[0022] Next, at the process shown in drawing 1 (b), the etching mask 6 of the etching initiation side for forming the ink feed hopper mentioned later is formed with a photolithography technique. Silicon oxide, a nitride, etc. are mainly used that what is necessary is just what can bear alkali etching liquid as an etching mask.

[0023] At the process shown in drawing 1 (c), the adhesion layer 8 concerning 1 operation gestalt of this invention is formed.

[0024] This adhesion layer 8 is formed in order to raise the adhesion of the etching protective layer in which the drive circuit of a substrate in which the exoergic resistance element was formed was formed and which receives a field (henceforth a device side) and is formed at a next process, and as shown in this drawing, it is formed so that the interior of a substrate may be surrounded around a silicon substrate. The adhesion layer 8 has good device side and adhesion which it is tolerant to an etching reagent, and mainly have silicon oxide, a nitride, etc. as a protective coat, and its adhesion is [ an etching protective layer ] still better. That is, as

compared with the case where a wax and rubber are used as an etching protective layer mentioned above, adhesion with a device side is raised further.

[0025] In addition, the adhesion layer 8 may be a thing of the silicon wafer for manufacturing two or more head chips formed in the periphery section at least, as shown in drawing 2. That is, it is because the etching protective coat mentioned later covers the whole wafer surface, so an etching reagent enters through the periphery section of the wafer.

[0026] Moreover, the configuration of an adhesion layer of not being restricted to what was explained above is natural, and may prepare an adhesion layer in the substrate with which a driver element etc. is formed, and may use an adhesion layer as it is as protective coats, such as a driver element. As an ingredient of an adhesion layer, be [ what is necessary / just although various above-mentioned demands are filled ], also in it, polyether amide resin is excellent in alkali etching resistance, and is good, has the advantage of being able to use also as a protective coat of an ink jet recording head further, and is especially desirable. [ of adhesion with the inorganic film of silicon ]

[0027] As polyether amide resin, it is HIMAL, for example. Can use HL-1200 (\*\*\*\* formation product made from industry), after coating this with the thickness of 2 micrometers with a spinner, it is made to dry (30-minute 100 degrees C and +250 degrees C, 60 minutes), and a photolithography technique performs patterning as shown in drawing 2 after that. This patterning can be performed by the same approach as the dry etching of the usual organic film. Namely, it can etch by the oxygen gas plasma by using the resist of a positive type as a mask. There should just be 1 micrometer - about 3 micrometers of thickness of an adhesion layer more preferably that there should just be 0.5 micrometers - 5 micrometers. When thickness is thin, it is easy to produce defects, such as pinfall, and when too thick, it may become the failure of a subsequent process. For example, it may become the failure of photolithography with the ink passage formation process mentioned later.

[0028] Next, as shown in drawing 1 (d), the behind removable mold material 3 is formed with a photolithography technique. As for this mold material, ink passage is formed by removing it like the after-mentioned. In this operation gestalt, this mold material 3 was formed by predetermined thickness and a predetermined pattern using positive type photoresist PMER-AR900 (TOKYO OHKA KOGYO CO., LTD.).

[0029] The orifice-plate material 4 including a delivery 5 is formed with a photolithography technique so that the mold material 3 formed by drawing 1 (d) may be covered with the process shown in drawing 1 (e). As orifice-plate material, a photosensitive epoxy resin, photosensitive acrylic resin, etc. can be used.

[0030] Furthermore, the etching protective coat 9 is formed at the process shown in drawing 1 (f).

[0031] That is, in order to protect the field in which the functional device which constitutes the drive circuit of the silicon substrate formed by the process of drawing 1 (a) - (e) was formed from the wet etching etching reagent performed at a subsequent process, protective coat formation is performed beforehand. In the case of this protective coat formation, the etching protective coat 9 raises adhesion in contact with the device side on the front face of a substrate through the adhesion layer 8 formed in the perimeter of a substrate 1, and, thereby, it can prevent good that an etching reagent permeates into a protective coat through the contact section of a protective coat and a device side.

[0032] The property of this protective coat is excellent in the alkali resistance in alkali etching, and adhesion with the adhesion layer especially mentioned above, and does not commit a functional device chemically, and it is still more desirable for it to be easily removable after etching. For example, \*\*, such as resin, a wax, etc. of a cyclized-rubber system, can be used. Since the resin of a cyclized-rubber system can be coated with ordinary temperature and is excellent in the resistance over alkali etching liquid, especially adhesion with the above-mentioned adhesion layer, it is especially desirable.

[0033] As resin of a cyclized-rubber system, the thing excluding the sensitization radical from the photoresist of the negative mold used with photolithography from the former and it etc. can be used. For example, TOKYO OHKA KOGYO OMR-83 (NEGARE cyst) and OBC (thing except a sensitization radical) can be mentioned. When using OBC, first, a spinner performs coating and, subsequently the etching protective coat 9 is formed of what is made to dry in oven (100 degrees C, 30 minutes). 10 micrometers - 20 micrometers of 5 micrometers - 30 micrometers of the thickness should exist preferably -- \*\* is good. When this thickness is



thin, it is easy to generate the defect of a pinhole etc., and in being thick, on the other hand, spreading and desiccation become difficult. Moreover, oven or a hot plate can also perform desiccation. The drying temperature has 90 degrees C - desirable 100 degrees C (from 30 minutes to about 90 minutes). It is because subsequent exfoliation may become difficult if \*\*\*\*\* 1 KU is performed at an elevated temperature. Furthermore, if needed, a protective coat may be applied so that the edge of a substrate may be surrounded. It cannot be overemphasized in that case that an adhesion layer is prepared in the rear face of a substrate as well as a front face.

[0034] Next, at the process drawing 1 (g) Shown, anisotropic etching is performed to a silicon substrate, a through tube is formed in a silicon substrate, and the ink feed hopper 7 is formed.

[0035] This operation gestalt performed predetermined time amount and anisotropic etching at 80 degrees C whenever [ etching solution temperature ] using the TMAH22wt% solution.

[0036] And exfoliation of the etching protective coat 9 is performed after etching termination. In the case of OBC used with this operation gestalt, it can exfoliate using a xylene. There are a DIP, a spray, etc. as a method of exfoliation.

[0037] Next, as shown in drawing 1 (h), dissolution removal of the mold material 3 is carried out that ink passage should be formed, and the main production process of an ink jet recording head is completed.

[0038] Drawing 3 is the outline perspective view showing an example of an ink jet printing equipment which can use the ink jet recording head obtained according to the above-mentioned operation gestalt.

[0039] In the ink jet printing equipment 100, carriage 101 engages with two guide shafts 104 and 105 which extend in parallel mutually possible [ sliding ]. Thereby, carriage 101 is movable in accordance with the guide shafts 104 and 105 with driving force transfer devices (all are un-illustrating), such as a belt which transmits the motor for a drive, and its driving force. The ink jet unit 103 which has an ink jet head and an ink tank as an ink container which contains the ink used with this head is carried in carriage 101.

[0040] The ink jet unit 103 consists of a tank as a container which contains the ink supplied to the head for carrying out the regurgitation of the ink, and this. That is, the tank formed corresponding to four heads which carry out the regurgitation of each ink of four colors of black (Bk), cyanogen (C), a Magenta (M), and yellow (Y), respectively, and these each is carried on carriage 101 as an ink jet unit 103. Each head and a tank are removable to mutual, and when the ink in a tank is lost, it is prepared so that only tanks can be exchanged for each ink color of every if needed. Moreover, of course, only a head is exchangeable if needed. In addition, as for the configuration of attachment and detachment of a head and a tank, it is needless to say that it is good also as a configuration with which it was not restricted to the above-mentioned example, but the head and the tank were fabricated by one.

[0041] It is inserted from the insertion opening 111 prepared in the front end section of equipment, finally the conveyance direction is reversed, and the form 106 as a print medium is conveyed by the lower part of the migration field of the above-mentioned carriage 101 with the delivery roller 109. A print is made to the print field on the form 106 supported by the platen 108 with the migration by this from the head carried in carriage 101.

[0042] Repeating the print of width of face and delivery of a form 106 corresponding to the width of face of the delivery array of the head accompanying migration of carriage 101 as mentioned above by turns, a print is made by the form 106 whole and a form 106 is discharged ahead [ equipment ].

[0043] In each heads and those lower parts on carriage 101, the recovery system unit 110 which can counter is formed in the left end of the movable field of carriage 101, and it can operate attracting ink etc. from the delivery of the actuation which caps the delivery of each head by this at the time of un-recording etc., or each head. Moreover, the predetermined location of this left end section is set up as a home position of a head.

[0044] On the other hand, the control unit 107 equipped with the switch or the display device is formed in the right end section of equipment. The switch in here is used at the time of ON/OFF of an equipment power source, or a setup of various printing modes etc., and a display device carries out the role which displays the various conditions of equipment.

[0045] (in addition to this) In addition, as mentioned above, especially, this invention is equipped with means (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink jet recording method in order to make the ink regurgitation perform, and brings about the

effectiveness which was excellent in the recording head of the method which makes the change of state of ink occur with said heat energy, and the recording device. It is because the densification of record and highly minute-ization can be attained according to this method.

[0046] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and liquid route where the liquid (ink) is held in the case of the mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports recording information and exceeds nucleate boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of a recording head is made to produce film boiling and the air bubbles in the liquid (ink) corresponding to this driving signal can be formed by one to one as a result, it is effective. A liquid (ink) is made to breathe out through opening for regurgitation by growth of these air bubbles, and contraction, and at least one drop is formed. If this driving signal is made into the shape of a pulse form, since growth contraction of air bubbles will be performed appropriately instantly, the regurgitation of a liquid (ink) excellent in especially responsibility can be attained, and it is more desirable. As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, further excellent record can be performed.

[0047] As a configuration of a recording head, the configuration using the U.S. Pat. No. 4558333 specification and U.S. Pat. No. 4459600 specification which indicate the configuration arranged to the field to which the heat operation section other than the combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) of a delivery which is indicated by each above-mentioned specification, a liquid route, and an electric thermal-conversion object is crooked is also included in this invention. In addition, the effectiveness of this invention is effective also as a configuration based on JP,59-138461,A which indicates the configuration whose puncturing which absorbs the pressure wave of JP,59-123670,A which indicates the configuration which uses a common slit as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, or heat energy is made to correspond to a discharge part. Namely, no matter the gestalt of a recording head may be what thing, it is because it can record now efficiently certainly according to this invention.

[0048] Furthermore, this invention is effectively applicable also to the recording head of the full line type which has the die length corresponding to the maximum width of the record medium which can record a recording device. As such a recording head, any of the configuration which fills the die length with the combination of two or more recording heads, and the configuration as one recording head formed in one are sufficient.

[0049] In addition, this invention is effective also when the thing of a serial type like an upper example also uses the recording head fixed to the body of equipment, the recording head exchangeable chip type to which the electric connection with the body of equipment and supply of the ink from the body of equipment are attained by the body of equipment being equipped, or the recording head of the cartridge type with which the ink tank was formed in the recording head itself in one.

[0050] Moreover, as a configuration of the recording device of this invention, since the effectiveness of this invention can be stabilized further, it is desirable to add the regurgitation recovery means of a recording head, a preliminary auxiliary means, etc. If these are mentioned concretely, a preheating means to heat using the capping means, the cleaning means, the pressurization or the suction means, the electric thermal-conversion object, the heating elements different from this, or such combination over a recording head, and a reserve regurgitation means to perform the regurgitation different from record can be mentioned.

[0051] Moreover, although only one piece was prepared also about the class thru/or the number of a recording head carried, for example corresponding to monochromatic ink, corresponding to two or more ink which differs in an others and record color or concentration, more than one may be prepared the number of pieces. That is, although not only the recording mode of only mainstream colors, such as black, but a

recording head may be constituted in one as a recording mode of a recording device or the paddle gap by two or more combination is sufficient, for example, this invention is very effective also in equipment equipped with at least one of each of the full color recording mode by the double color color of a different color, or color mixture.

[0052] Furthermore, in addition, in this invention example explained above, although ink is explained as a liquid It is ink solidified less than [ a room temperature or it ], and what is softened or liquefied at a room temperature may be used. Or by the ink jet method, since what carries out temperature control is common as a temperature control is performed for ink itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stabilization regurgitation range about the viscosity of ink, ink may use what makes the shape of liquid at the time of use record signal grant. In addition, in order to prevent the temperature up by heat energy positively because you make it use it as energy of the change of state from a solid condition to the liquid condition of ink, or in order to prevent evaporation of ink, the ink which solidifies in the state of neglect and is liquefied with heating may be used. Anyway, ink liquefies by grant according to the record signal of heat energy, and this invention can be applied also when using the ink of the property which will not be liquefied without grant of heat energy, such as that by which liquefied ink is breathed out, and a thing which it already begins to solidify when reaching a record medium. The ink in such a case is good for a porosity sheet crevice or a through tube which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each ink mentioned above.

[0053] Furthermore, in addition, as a gestalt of this invention ink jet recording device, although used as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc. and the facsimile apparatus which has a transceiver function further may be taken.

[0054]

[Effect of the Invention] Since according to this invention the protective coat to the etching reagent used for etching is prepared and an adhesion layer is formed in the part which the predetermined layer of a protective coat and a substrate touches in this case as explained above, the adhesion of a protective coat and a substrate can be raised and it can prevent that an etching reagent permeates into a protective coat.

[0055] Consequently, the manufacture of an ink jet recording head with high still more sufficient productive efficiency of the yield is attained, without doing damage to a device side, in case an ink feed hopper etc. is formed by wet etching.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] (a) - (h) is drawing showing the production process of the ink jet recording head concerning 1 operation gestalt of this invention.

[Drawing 2] It is drawing showing the silicon wafer in the above-mentioned production process.

[Drawing 3] It is the perspective view showing the outline configuration of the ink jet recording device using the ink jet recording head manufactured with the above-mentioned operation gestalt.

[Description of Notations]

- 1 Silicon Substrate
- 2 Exoergic Resistance Element
- 3 Mold Material
- 4 Orifice-Plate Material
- 5 Delivery
- 6 Etching Mask
- 7 Ink Feed Hopper
- 8 Adhesion Layer
- 9 Etching Protective Coat

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[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

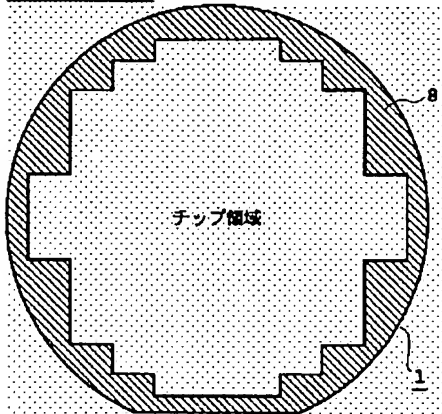
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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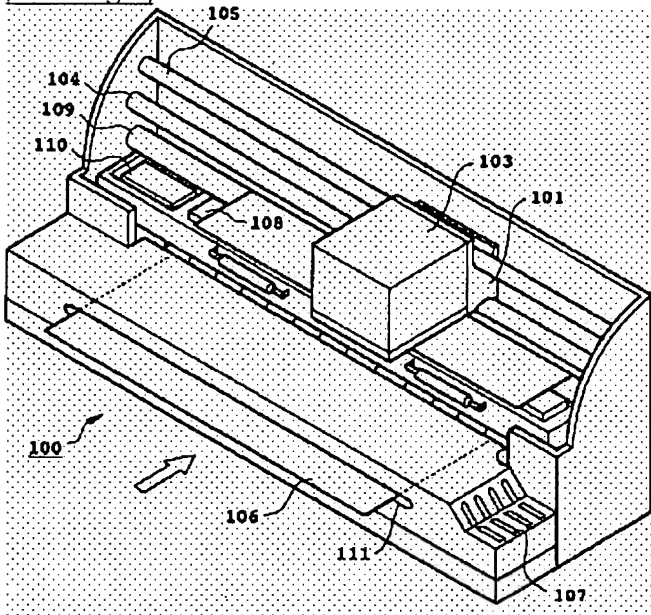
DRAWINGS

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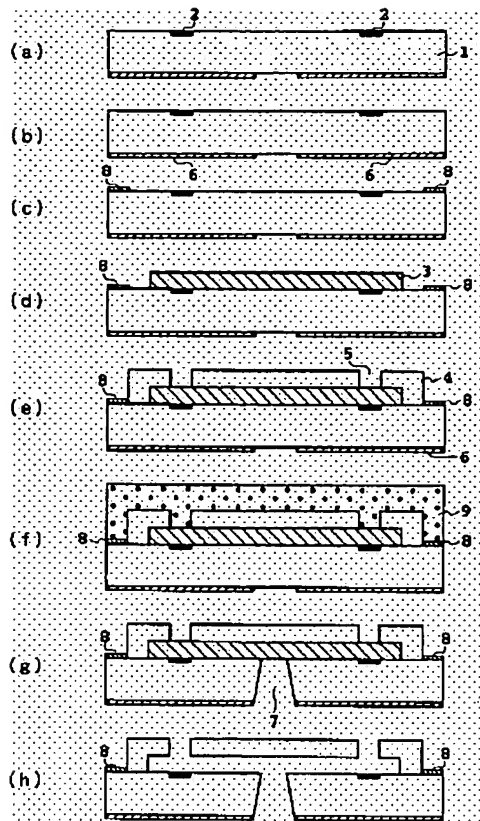
[Drawing 2]



[Drawing 3]



[Drawing 1]



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[Translation done.]